Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **30 SEP 2013**	2. REPORT TYPE	3. DATES COVERED **00-00-2013 to 00-00-2013**
4. TITLE AND SUBTITLE **Characterizing Surface Transport Barriers in the South China Sea**		5a. CONTRACT NUMBER
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)		5d. PROJECT NUMBER
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Massachusetts Institute of Technology,Department of Mechanical Engineering,Cambridge,MA,02139**		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**2**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Characterizing Surface Transport Barriers in the South China Sea

Thomas Peacock
Mechanical Engineering, MIT
Cambridge, MA 02139
phone: (617) 258-0736 fax: (617) 258-8742 email: tomp@mit.edu

Award Number: N000141210665
http://web.mit.ed/endlab

LONG-TERM GOALS

The long term goal of this project is to advance the state of the art in mathematical methods for detecting key transport structures in velocity field data sets for spatially complex, time-dependent, ocean surface flows. Such transport structures are typically not inherently obvious in snapshots of the Eulerian velocity field and require analysis methods with foundations in Lagrangian flow transport. Within the context of this DRI, a long term goal is to improve understanding of the formation and location of submesoscale fronts in the South China Sea (SCS).

OBJECTIVES

The scientific objective is to test and develop novel methods, with a focus of the approach of Lagrangian Coherent Structures (LCSs). We seek to demonstrate the utility and robustness of the method through application to ocean data sets pertaining the SCS, and more specifically the region immediately to the southwest of Taiwan. Furthermore, we seek to directly apply these methods to data sets from HF radar, with a view to providing support for field studies in 2014 that are the focus of the DRI.

APPROACH

The approach involves using MATLAB based software to perform processing of the data sets. The code has been developed by a graduate student (Allshouse) and a postdoc (Leclair). Data sets for analysis are provided by other members of the DRI, and we are seeking to obtain a viable HF radar data stream via the Taiwanese TORI network.

WORK COMPLETED

At this stage, the LCS code has been established, streamlined and tested on a number of ocean data sets. The code can now be used to analyze surface velocity field data sets relevant to the SCS, handling issues of challenging coastline structures and large domains requiring a large number of particle advection calculations. We have established close interactions with the ocean modeling group at Rutgers University in order to continue relevant LCS analysis.

RESULTS

The key results at this realtively early stage are the LCS calculations for the entire SCS using a numerically generated data set. An example result is presented in figure 1, which shows the repelling LCSs across the SCS calcualted for a 36 hour time window. Regions of high value Finite Time Lyapunov Exponent (FTLE), in yellow, highlight the most kinematically active regions of the flow domain. The analysis immediately reveals the key transport regions, with the area of focus at the southern end of Taiwan and northern end of the Luzon Strait being very active and containing much sub-meoscale structure, largely due to the presence of the Kuroshio.

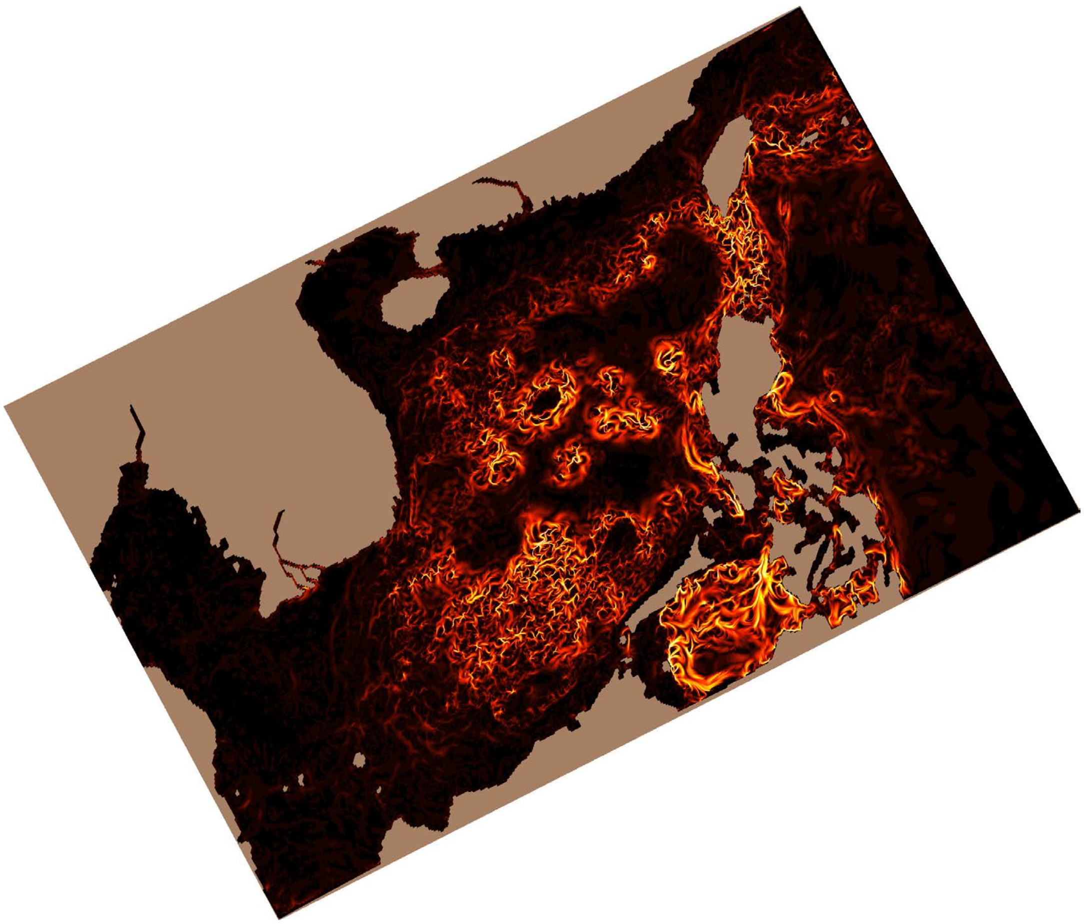

Figure 1: Repelling LCSs across the SCS calculated for a 36 hour time period using a data set provided by the ocean modeling group at Rutgers University, courtesy of John Wilkin.

IMPACT/APPLICATIONS

There is widespread potential impact for this research as it provides new insight into transport prooperties of unsteady flows. Applications range from improved fundamental understanding of the relationship between submesoscale fronts the kinematics of surface velocity fields to improved support for ocean decision making strategies, such as search-and-rescue operations and pollution spills.